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Scanning tunnelling spectroscopy as a probe of multi-Q magnetic states of itinerant magnets

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Abstract

© The Author(s) 2017. The combination of electronic correlations and Fermi surfaces with multiple nesting vectors can lead to the appearance of complex multi-Q magnetic ground states, hosting unusual states such as chiral density waves and quantum Hall insulators. Distinguishing single-Q and multi-Q magnetic phases is however a notoriously difficult experimental problem. Here we propose theoretically that the local density of states (LDOS) near a magnetic impurity, whose orientation may be controlled by an external magnetic field, can be used to map out the detailed magnetic configuration of an itinerant system and distinguish unambiguously between single-Q and multi-Q phases. We demonstrate this concept by computing and contrasting the LDOS near a magnetic impurity embedded in three different magnetic ground states relevant to iron-based superconductors - one single-Q and two double-Q phases. Our results open a promising avenue to investigate the complex magnetic configurations in itinerant systems via standard scanning tunnelling spectroscopy, without requiring spin-resolved capability.

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